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PATENT SPECIFICATION

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PROVISIONAL SPECIFICATION

Improvements in or relating to Drainage and Sewerage Systems and Pipes therefor

I, DOUGLAS WHITAKER, a British Subject, of 56, Victoria Street, London, S.W.1, do hereby declare the nature of this invention to be as follows:—

This invention appertains to drainage and sewerage systems and pipes for use therein. It is mainly applicable to the drainage of land in which porous pipes are used but it may also be applied with advantage to drainage and sewerage systems in which earthenware, stoneware or other non-porous pipes are used.

The principal objects of the invention are to increase the efficiency of land drainage systems and to reduce the fall required for pipe lines in drainage and sewerage systems.

In connection with ground drainage systems where porous pipes are used, it has been discovered that the efficiency of such pipes is highest when they are in a moist condition, this being probably due to the capillary action in the walls of the pipes tending to draw the moisture from the surrounding soil. In times of drought when evaporation of the moisture in the soil in which the pipes are laid is likely to occur, the pipes tend to become dry; this is particularly noticeable in light soils. When in a dry condition the porous drain pipes are sluggish in starting to function for drainage purposes when occasion requires and they do not assume their maximum efficiency until they have again become saturated.

My proposal is to construct and/or lay drainage and sewerage pipes in such a manner that they will be adapted to retain moisture on the inside at the bottom.

My idea is to so arrange matters that after cessation of flow of liquid through the pipes, pools of moisture will remain therein.

In connection with ground drainage by porous pipes, the retention of pools of moisture in the pipes after flow through them has ceased, provides the important advantage that such pools keep the pipes in a moist condition. By keeping the body of a porous pipe moist such pipe is in a favourable condition to start up the equalising of the moisture in the surrounding soils. In other words, when the body of a porous pipe is in a moist condition it is more effective for absorbing moisture through its walls from the surrounding soil than it is when in a dry condition.

In addition to the advantage above mentioned, the retention of pools of moisture in the porous pipes keeps the inside wet which condition facilitates the flow of water through the pipes. It is in this connection that the application of the invention to earthenware, stoneware and other non-porous pipes, such for example as in other drainage systems and in sewerage systems, is useful seeing that by keeping the inside of the pipes moist, surface tension is reduced and therefore flow of liquid through the pipes is facilitated, in consequence of which a less fall is required this being an important consideration especially in sewerage systems and in the drainage of roads, railway tracks and the like.

The invention may be carried out by constructing and/or laying the pipes so that on the inside bottom thereof there will be depressions, cavities, channels, recesses or other formations which will come below the level at which longitudinal flow of liquid through the pipes occurs; being disposed below the level at which flow takes place through the pipes these depressions or other formations act as reservoirs to retain moisture and thus provide pools of liquid along the interior bottom of the pipe line for the purpose aforesaid.

In the preferred embodiment of the invention the pipes are made with a tapered interior, that is to say they are made larger in size interiorly at one end than at the other end. In use these pipes are laid in line either with the like ends of adjacent pipes together, i.e. large end to large end and small end to small end, or with the unlike ends of adjacent pipes together, i.e. small end to large end. In these arrangements since the longitudinal flow of liquid through the pipes can only take place through the small ends, it follows that the larger interior portions of the pipes will at the bottom serve to re-

[*Price* 1/-]

Price 3½p

tain the moisture which cannot flow through the small ends. In the first mentioned arrangement where the pipes are laid large end to large end and small end to small end, sucessive pairs of pipes will have a reservoir at the bottom in the form of an invert, that is to say each two adjacent pipes which have their large ends meeting will conjointly form on the inside bottom a reservoir which in length extends between the remote smaller ends of the two pipes; the bottom of this reservoir which is constituted by the lower portions of the adjacent pipes between the large and small end of each is oppositely upwardly inclined in a longitudinal direction which formation is above referred to as an invert. In the second mentioned arrangement where the pipes are laid small end to large end, each pipe forms a reservoir at the bottom; such reservoir extends longitudinally from the small end of the pipe to the large end of the same pipe its bottom being downwardly inclined in the same direction and the small end of the next adjacent pipe constitutes the end wall of said reservoir at its deep end.

Thus a pipe line composed of pipes having tapered interiors and laid according to the first of the before mentioned arrangements will have an interior bottom of undulating character in a lengthwise direction, i.e. alternating upward and downward inclines, and each depression will act as a reservoir to retain liquid after the flow of the latter through the pipes has ceased. In the second mentioned arrangement the interior bottom of the pipe line will present in a longitudinal direction a succession of inclines with shoulders between and each depression will act as a reservoir to retain liquid.

Pipes having a tapered interior which taper extends throughout the length of the pipe from large to small end are not only considered to be useful for the purpose in view but they have the further advantage of being capable of easy manufacture especially when made in moulds with which cores are used as the tapered interior facilitates removal of the core from the moulded pipe.

The pipes may, however, be otherwise formed to enable the object of the invention to be attained. For instance, instead of the interior of a pipe being tapered from one end to the other, it may be reduced in size at one or more places intermediate of its ends. In one example the pipe may have its smallest internal diameter in the middle and gradually enlarge from this towards each end and in such case the opposite ends would be of equal size. In a pipe line composed of these pipes the internal reservoirs would be formed conjointly by adjacent pipes as in the two arrangements previously described herein.

I may according to another embodiment of my invention construct the pipes so that each will provide a reservoir of self-contained form, i.e. without assistance by the adjacent pipe. For this purpose the inside of the pipe may be made larger at one or more places intermediate of its ends; for example it may be made larger in the middle than at the ends as for instance barrel shaped or oppositely tapered; that portion of the interior which is larger than the open ends will act as a reservoir between the ends.

Instead of using pipes which are specially formed interiorly as hereinbefore described, I may carry out my invention and achieve the object in view by laying ordinary or parallel bore pipes in an improved manner so as to produce internal reservoirs for retaining moisture for the purpose stated. This may be done by laying the pipes of the kind mentioned so that they are alternately upwardly and downwardly inclined and have their meeting ends in register or so that they are all inclined in the same direction and have their meeting ends vertically offset. In the first case the pipe line will be of undulating form and the lower parts of the pipes in the depressions of the line will form reservoirs to retain moisture, while in the second case the lower ends of the inclined pipes conjointly with the offset ends of the adjacent pipes will form reservoirs for the same purpose.

The pipes may or may not be jointed at their meeting ends; for example they may be of spigot and socket, flanged or other known formations or they may simply butt. When the internal reservoir is formed conjointly by two adjacent pipes as herein described, the jointed or meeting ends of said pipes may be tightly rammed with soil on the outside to prevent leaking of the moisture from the reservoir.

If as previously suggested herein parallel bore pipes are used and laid alternately upwardly and downwardly inclined, I may make such pipes with ends slightly off square, the angularity being suitable to the proposed inclination to enable the ends of adjacent pipes to meet and avoid formation of an angular gap.

The pipes may be of any desired cross sectional shape interiorly and exteriorly. For land drainage systems the invention is eminently suitable for application to porous pipes made of concrete or similar material which pipes are solid or non-porous at the bottom. The invention is not of course limited to such application as it may be applied to pipes of other

kinds.

It will thus be seen that a pipe line can be constructed as herein described to contain a succession of long pools of moisture the advantages of which have already been mentioned herein and to which I would add that I believe the keeping of the inside of the pipes in a wet condition will not only give an easier flow of liquid when required but will also reduce the tendency of the pipes to become silted up or dirty. It is also thought that the present invention will make possible the laying of ground drainage pipes level or with a fall of 1 in 1000.

By way of practical example I may mention that a porous pipe of concrete suitable for ground drainage and embodying the invention may have a length of 2 feet and outside diameter of 5¼ inches the interior being gradually tapered from 4" diameter at one end to 3½" diameter at the other. If made without a flange or socket at the end these pipes would be preferably laid with the large ends to large ends and the small ends to small ends so that long pools of water would be left on the inverts. If the pipes are made with a flange or socket then they would be laid large end to small end and there would be separate pools in each pipe. The dimensions given are merely an example, the pipes may be made in any size and proportion desired.

The internally tapered pipes when made with a socketted end may be formed right and left handed, i.e. some with the large end at the socket and others with the small end at the socket; this enables the pipes to be laid large end to large end and small end to small end to produce long interior pools as already described. Pipes having other end formations for fitting together or jointing may be similarly formed for a like purpose.

In the foregoing description the pipes are visualized as being in a horizontal position as when in use.

Dated this 1st day of April, 1942.

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COMPLETE SPECIFICATION

Improvements in or relating to Drainage and Sewerage Systems and Pipes therefor

I, DOUGLAS WHITAKER, a British Subject, of 56, Victoria Street, London, S.W.1, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention appertains to drainage and sewerage systems and pipes for use therein. It is mainly applicable to the drainage of land in which porous pipes are used but it may also be applied with advantage to drainage and sewerage systems in which earthenware, stoneware or other non-porous pipes are used.

The principal objects of the invention are to increase the efficiency of land drainage systems and to reduce the fall required for pipe lines in drainage and sewerage systems.

In connection with ground drainage systems where porous pipes are used, it has been discovered that the efficiency of such pipes is highest when they are in a moist condition, this being probably due to the capillary action in the walls of the pipes tending to draw the moisture from the surrounding soil. In times of drought when evaporation of the moisture in the soil in which the pipes are laid is likely to occur, the pipes tend to become dry; this is particularly noticeable in light soils. When in a dry condition the porous drain pipes are sluggish in starting to function for drainage purposes when occasion requires and they do not assume their maximum efficiency until they have again become saturated.

My proposal is to construct and lay drainage and sewerage pipes in such a manner that they will be adapted to retain liquid or moisture on the inside at the bottom.

My idea is to so arrange matters that after cessation of flow of liquid through the pipes, pools of liquid or moisture will remain therein.

In connection with ground drainage by porous pipes, the retention of pools of liquid or moisture in the pipes after flow through them has ceased, provides the important advantage that such pools keep the pipes in a moist condition. By keeping the body of a porous pipe moist such pipe is in a favourable condition to start up the equalising of the moisture in the surrounding soils. In other words, when the body of a porous pipe is in a moist condition it is more effective for absorbing moisture through its walls from the surrounding soil than it is when in a dry condition.

In addition to the advantage above mentioned, the retention of pools of liquid or moisture in the porous pipes keeps the inside wet which condition facilitates the flow of water through the pipes. It is in this connection that the application of the invention to earthenware, stoneware and other non-porous pipes, such for example as in other drainage systems and in sewerage systems, is useful seeing that by keeping the inside of the pipes moist, surface tension is reduced and therefor flow of liquid through the pipes is facilitated, in consequence of which a less fall is required, this being an important consideration especially in sewerage systems and in the drainage of roads, railway tracks and the like.

According to the invention drainage or sewerage pipes are constructed so that they are parallel exteriorly and are interiorly tapered thus being larger in size interiorly at one end than at the other end the taper extending continuously from the larger end to the small end of the pipes. When these pipes are laid in line, the interior tapers will form depressions or recesses which will be disposed below the level at which longitudinal flow of the liquid through the pipes occurs and will act as reservoirs to retain liquid or moisture and thus provide pools of liquid or moisture along the interior bottom of the pipe line for the purpose aforesaid.

In order that the invention may be more clearly understood and readily carried into practical effect, some specific examples thereof will now be described with reference to the accompanying drawings, wherein,

Figure 1 shows, in elevation, a portion of a pipe line composed of pipes constructed and laid in accordance with the preferred embodiment of the invention,

Figure 2 is a longitudinal sectional view of the same to show the pools of liquid or moisture along the interior bottom of the pipe line,

Figure 3 is a longitudinal sectional view of a portion of a further pipe line composed of similar pipes laid in a different manner, as will be hereinafter explained,

Figure 4 is a transverse sectional view taken on the line IV—IV of Figure 2,

Figure 5 shows, in elevation, a portion of a pipe line composed of socketted pipes constructed in accordance with the invention,

Figure 6 is a longitudinal sectional view of the pipes shown in Figure 5,

Figure 7 is a view similar to Figure 6 including pipes with socketted ends formed right and left handed for a purpose hereinafter to be explained.

Like parts are designated by similar reference characters throughout the drawings.

In the example illustrated in Figures 1 and 2, each of the separate pipes 1 is exteriorly parallel and is made with a continuous tapered interior or bore 2. That is to say, each pipe is made larger in size interiorly at one end than at the other end and the interior tapers continuously from the larger end to the small end. Thus, referring to Figure 2, it will be seen that the diameter d at the end 3 of a pipe is somewhat larger than the diameter d' at the opposite end 4, the taper extending from end 3 to end 4. In use these pipes are laid level so as to form a horizontally extending pipe line. Moreover, in the particular example now being described the pipes 1 are laid in line with the unlike ends of adjacent pipes together, i.e. small end 4 to large end 3. In this arrangement since the longitudinal flow of liquid through the pipes 1 can only take place through the small ends 4, it follows that the larger interior portions of the pipes will at the bottom serve to retain the liquid or moisture which cannot flow through said small ends. Thus, each pipe forms a reservoir at the bottom for a pool 5 of liquid or moisture. Such reservoir extends longitudinally from the small end 4 of the pipe to the large end 3 of the same pipe, its bottom being downwardly inclined in the same direction and the small end of the next adjacent pipe constitutes the end wall of said reservoir at its deep end (see Figure 2). In this arrangement, then, the interior bottom of the pipe line will present in a longitudinal direction a succession of inclines with shoulders 6 between, and each depression 7 (Figure 1) will act as a reservoir to retain a pool 5 of liquid or moisture. One of these pools in the bottom of a pipe is shown to advantage in Figure 4.

In the example illustrated in Figure 3, pipes 1 of the same form as those shown in Figures 1 and 2 are used, but in this instance they are laid in line with the like ends of adjacent pipes together, i.e. large end 3 to large end 3 and small end 4 to small end 4. Accordingly, successive pairs of pipes 1 will have a reservoir 8 at the bottom in the form of an invert, that is to say each two adjacent pipes which have their large ends 3 meeting will conjointly form on the inside bottom a reservoir which in length extends between the remote smaller ends 4 of the two pipes; the bottom of this reservoir which is constituted by the lower portions of the adjacent pipes between the large and small end of each is oppositely upwardly inclined in a longitudinal direction which formation is above referred to as an invert.

Thus a pipe line composed of pipes 1 having tapered interiors 2 and laid in the manner shown in Figure 3 will have an interior bottom of undulating character in a lengthwise direction, i.e. alternating upward and downward inclines, and each depression will act as a reservoir to retain a pool 5¹ of liquid or moisture after the flow of the latter through the pipes has ceased.

The pipes shown in Figures 1 to 3 are plain-ended and simply butt when laid.

Referring now to Figures 5 and 6, it will be seen that the pipes 1¹ are exteriorly parallel and formed with continuous tapered interiors or bores 2¹ and are consequently generally similar to the pipes 1 previously described. The pipes 1¹, however, are somewhat longer and made with socketted ends. The sockets 9 are formed integrally with the small ends 4¹ of the pipes 1¹ so that the latter, when assembled, are in the same relation as the pipes 1 in the example depicted in Figures 1 and 2, that is to say with small end 4¹ to large end 3¹ throughout the line.

Alternatively, as shown in Figure 7, the parallel exterior, interiorly tapered pipes made with socketted ends may be formed right and left handed, i.e. some with the large end 3¹ at the socket 9 and others with the small end 4¹ at the socket; this enables the pipes to be laid large end 3¹ to large end 3¹ and small end 4¹ to small end 4¹ as shown, to produce long interior pools 5¹ as already described.

Pipes such as those already described having a parallel exterior and a tapered interior, which taper extends throughout the length of the pipe from large to small end, are not only considered to be useful for the purpose in view but they have the further advantage of being capable of easy manufacture especially when made in moulds with which cores are used as the tapered interior facilitates removal of the core from the moulded pipe. The exteriorly parallel formation of the pipes is advantageous in that it enables such pipes to be readily laid level or in horizontal alignment in a trench or channel having a longitudinal flat bottom.

It is preferred to arrange for the longitudinal flow of liquid through the pipes to take place in the direction of the arrows A in Figures 2 and 5 since in this direction the downward inclination of the bottoms of the pipes will be conducive to the flow —at least until such time as the reservoirs become full. It may however, be arranged for the flow of liquid through the pipes to take place in the opposite direction to that above indicated. With regard to the examples shown in Figures 3 and 7, it is immaterial in which direction the longitudinal flow of liquid takes place.

The improved pipes, instead of being provided with sockets of the form shown in Figures 5, 6 and 7, may have interengaging ends of the spigot and socket type, or they may have flanged or any other known formations for jointing purposes. In any event, and whatever the form of the pipes adopted, the meeting or interengaging ends of the pipes are preferably packed or rammed with clay or any other suitable substance or jointing material to prevent leakage of liquid or moisture from the reservoirs. Some such packing or the like is, of course, essential in cases where each internal reservoir is formed conjointly by two adjacent pipes as, for instance, as shown in Figures 3 and 7. In Figure 1, the pipes are shown laid in soil, and, by way of example, jointing substance or material *j* is shown beneath the butting ends of the pipes.

Whatever substance or jointing material is used, this may be packed or rammed all round the pipes or, as shown at *j*¹ in Figure 4, only around the bottom portions of the pipes from which leakage is likely to occur. In cases where the pipes are laid in clay soil, the clay may be simply wetted and rammed back thereby obviating the necessity of making prepared independent joints, since liquid from the reservoirs cannot run back into clay.

In all cases, the starting end of the pipe line would be filled up in any suitable manner.

The pipes may be of any desired cross sectional shape interiorly and exteriorly though a circular cross section is preferred. For land drainage systems the invention is eminently suitable for application to porous pipes made of concrete or similar material which pipes are solid or non-porous at the bottom. The invention is not of course limited to such application as it may be applied to pipes of other kinds.

It will thus be seen that a pipe line can be constructed as herein described to contain a succession of long pools of liquid or moisture the advantages of which have already been mentioned herein and to which I would add that I believe the keeping of the inside of the pipes in a wet condition will not only give an easier flow of liquid when required but will also reduce the tendency of the pipes to become silted up or dirty. It is also thought that the present invention will make possible the laying of ground drainage pipes level, as in the particular examples illustrated, or with a fall of 1 in 1000.

By way of further exemplification I

may mention that pipes such as those shown in Figures 1—4 may have a length of 1 foot and outside diameter of 5¼ inches, the interior being gradually tapered from 4 inches diameter at one end to 3¼ inches diameter at the other. The length of the tapered interior or bore of a pipe such as that shown in Figure 6 or Figure 7, i.e. the dimension *l*, may be 1 foot 6 inches.

With regard to the tapered interiors of the pipes such as shown in the drawings, I find that a taper proportioned to provide a fall of 1 in 48 on the inside bottom when the pipes are laid level is appropriate for the purpose in view. This fall is, however, merely an example and, like the dimensions previously mentioned, may be varied according to requirements or desire.

It has been proposed to provide on the inner wall of a tube for conveyance of fluids, inclined steps in the direction of the flow, so as to form partial vacuum chambers which, by the formation of eddy currents, retard the flow of a portion of the fluid stream in such a way that the frictional resistance to the flow of the main fluid stream will only occur between the main flow of fluid and the portion referred to and not between the fluid and the tube wall. Such proposed tube had a parallel exterior but the inclined steps on its inner wall produced a series of internal tapers between its opposite ends and the drainage or sewerage pipe constituting my invention is distinguished from such proposed tube in that it has a single interior taper which extends continuously from one end of the pipe to the other.

I am aware that porous tubular irregating tiles have been proposed which have been tapered both interiorly and exteriorly, the interior taper of each tile extending continuously from one end to the other and being formed with an integral transverse dam at the smaller end, the said tiles being telescopically connected and their interior tapers forming reservoirs or chambers for holding water at the bottom. The drainage or sewerage pipes constituting my invention are distinguished from such proposed tiles in that they are exteriorly parallel and are not provided with transverse dams inside their smaller ends.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A drainage or a sewerage pipe which is parallel exteriorly and is interiorly tapered so that it is larger in size interiorly at one end than at the other end the taper extending continuously from the larger end to the small end of the pipe, for the purposes specified.

2. A pipe line to be used for drainage or sewerage, wherein pipes as claimed in Claim 1 are laid in line with the unlike ends of adjacent pipes together, i.e. small end to large end, each pipe thereby forming at the bottom a reservoir for the retention of a pool of liquid or moisture, for the purposes specified.

3. A pipe line to be used for drainage or sewerage, wherein pipes as claimed in Claim 1 are laid in line with the like ends of adjacent pipes together, i.e. large end to large end and small end to small end, successive pairs of pipes thereby having a reservoir at the bottom in the form of an invert for the retention of a pool of liquid or moisture, for the purposes specified.

4. For a pipe line as claimed in Claim 2 or 3, pipes which are plain ended.

5. For a pipe line as claimed in claim 2 or 3, pipes which have a pocket at one end for jointing.

6. For a pipe line as claimed in Claim 2 or 3, pipes which have spigot and pocket ends or are flanged for jointing purposes.

7. A pipe line constructed and adapted for use substantially as and for the purposes herein specifically described with reference to Figures 1 and 2, Figure 3, Figures 5 and 6, or Figure 7 respectively of the accompanying drawings.

Dated this 3rd day of December, 1942.

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Agents for the Applicant.

Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1943

FIG. 1.

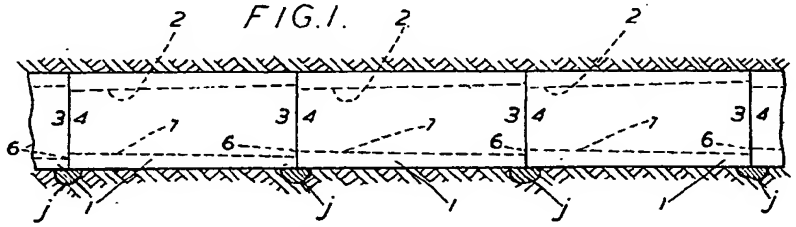


FIG. 2.

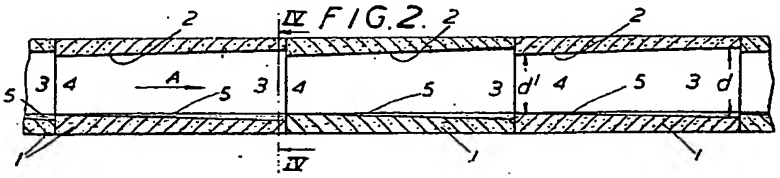


FIG. 3.

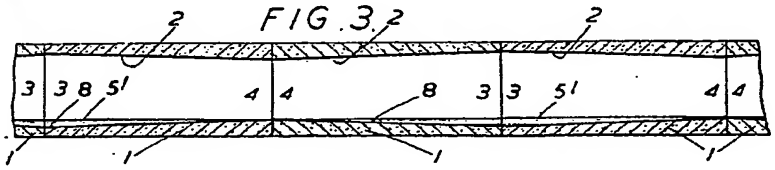


FIG. 4.

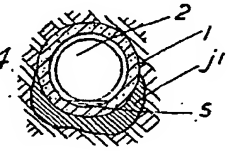


FIG. 5.

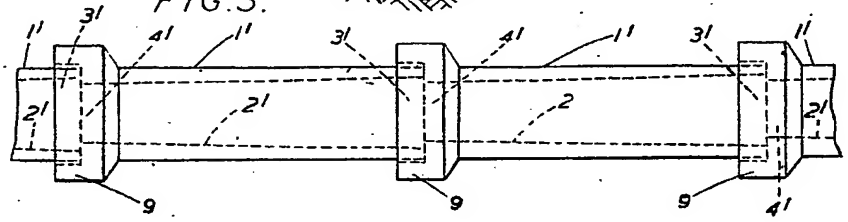


FIG. 6.

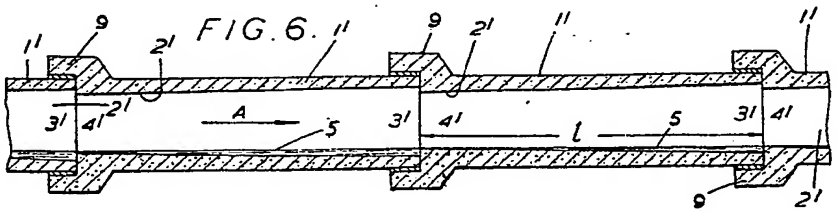
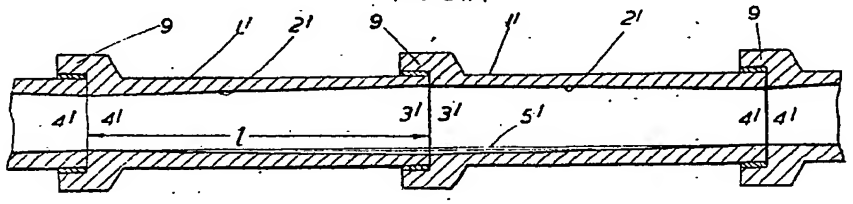


FIG. 7.



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